MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
RAILROAD OPERATIONS

GENERAL GUIDELINES FOR THE DESIGN OF PASSENGER TRAIN LAYOVER FACILITIES

DYER
THOMAS K. DYER, INC.

Interoffice Correspondence

FILE COPY
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To: Track Staff Date: December 10, 1992

From: Ralph Mazzeo RCM

Subject: Phone Call with Neil Mullaney - MBTA Concerning Layover Facility Requirements

Neil indicated that Railroad Operations is currently doing an internal review of layover facilities. Bill MacDonald has recently circulated a copy of standards DYER prepared about 6 years ago asking for their review and comment. Neil offered to send a copy of his marked-up comments, understanding that he may get overruled.

Key points discussed:

- Neil did not indicate any preference for track spacing.
- Train consists can be connected to layover power at any place in consist on either side. They generally prefer locomotive end however.
- Neil does not think that toilet dumping facilities are necessary. There is a labor issue, cleaning personnel at layovers do not want to and/or are not qualified to handle this function which also requires flushing the retention tank and discharge hose. Task is done at daily visit to S & I facilities in Town.
- Neil does not believe yard hydrants are necessary except at locomotive end for filling radiators. The only cars that currently have toilets are the Meschershmidt cars. They try to have at least one of these cars in every consist. Cars have a 60 gallon water tank. The filler pipe is down under the car between vestibule and truck and on one side only. These can be filled on a daily trip to S & I facility in Town.
- At the small maintenance building, they need an electric hoist to get 55 gallon lube oil drums onto the back of the Cushman Carts. Oil must be kept warm inside the maintenance building. At locomotive, they use a small air operated pump (air supplied by locomotive) to pump oil to prime mover and head-end unit as needed.

  (We sent Neil a catalog cut of a device simpler than electric hoist to lift oil drums.)

~~RES~~ WPS GEH
12-1/11 ~~DGM~~ DLB
~~RER~~ JHT
~~SWH~~ SEK
MJM DJM
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CONTENTS

OVERVIEW

Passenger train layover facilities are provided at the outer terminus of commuter rail lines. Their primary benefit is that they eliminate "deadhead" movements (non revenue, passenger carrying runs) back to a central facility at night and out to the end of the line in the early morning. In addition to providing secure overnight storage of the trainsets, they include an electric power source to maintain heat while the locomotive (the usual power source) is shut down. Minimal servicing is done at layover facilities and is generally limited to topping off locomotive cooling systems, adding lubricating oil, inspections and car cleaning. Toilet dumping facilities should be provided adjacent to the storage tracks to allow discharging on-train lavatory retention tanks. For maintenance functions, a small heated storage building is required to store material. This building should also include a small office for preparing and filing maintenance reports and health and welfare facilities (toilet, sink, hot water and lockers) for maintainers. The layover facility should also provide, a secure (fenced) parking area for the expected number of employees, both operating and maintenance.

LIMITATIONS OF THESE GUIDELINES

It must be emphasized that these are general guidelines for designing a layover facility. There are many site specific variables that will require changes and additions. It is also the responsibility of the designer of a specific layover facility to contact appropriate authorities to ascertain that the design will be in compliance with requirements at the time of construction.

GENERAL LAYOUT OF FACILITY

Most of the basic dimensions and actual arrangement must be on a site specific basis, however, the following are desireable minimums and important considerations which should be strived for.

- The facility should be located close to the last station on the line. (To minimize deadhead movements)
- It should be off to one side of the existing main track (if there is a main track continuing beyond) and be generally parallel to the main track.
- The length and number of tracks should be adequate to handle the number and length of trainsets required. (85 foot long cars and 60'-70' long locomotives). When more than one trainset is stored on a track, provide 75' of space between the trains. The minimum size of a facility is four nine car trainsets.

- The track layout is preferred to be double ended so that trains can access the main track from either end. This provides more operational flexibility and prevents the equipment from being "bottled-up" in the event of a derailment or break down on one end.

- The centerline to centerline distance between a main track and the closest track in the layover facility should be 27'-0" minimum. This allows 17'-0" from the main line to the fence around the layover facility for snow storage, maintenance and general safety requirements and at least 9'-6" inside the layover for similar reasons.

- The minimum centerline to centerline distance between storage tracks in the body of the facility should be 35'-0". This allows an access road/work area 23'-6" wide between the tracks with the pavement ending 5'-9" from the track center line. In larger facilities, alternating tracks may have 15'-0" track centers with the access roads alternating between the paired tracks.

- Provide grade crossings and access drives within the facility at locations where trains will not block them. The vehicle access and circulation pattern should be planned to allow fuel trucks, emergency vehicles and maintenance trucks access to all trainsets with a minimum of backing and no turning around. (Impossible with 24± feet of pavement).

TRACK DESIGN

Subgrade

Sub-ballast is desirable in all areas where the existing subgrade consists of any materials which is not a well graded, normally dry, free draining, well compacted gravel material. When the use of subballast is indicated, it should be a minimum of 6" thick with up to 8" where the underlying material is poor. Subballast shall consist of clean, hard, durable, angular stone graded as shown in the table below so that is will form a dense, stable mat for the ballast section, protecting the ballast from fines being pumped into it. In very wet areas with fine soil particles, consideration should be given to placing geotextile fabric under the subballast to help protect it from being fouled with fines and increase the bearing capacity of the subgrade.

Grading Requirements For Subballast

Sieve Size	Percent Passing By Weight	
	Minimum	Maximum
1 inch	90	100
3/8 inch	50	85
No. 10	25	50
No. 40	10	30
No. 200*	4	10

*The percentage passing the No. 200 shall not exceed 50 percent of the percentage passing the No. 40.

Ballast

Ballast should not be less than 6 inches deep below the bottom of ties of A.R.E.A. Size No. 4 crushed stone ballast.

Ties

Ties should be 8'-6" x 7" x 9" pressure treated timber.

Rail

Rail should be new or fit relay not less than 115 lb. section.

Turnouts

Turnouts in the main track leading to the layover facility shall not be less than No. 10. Turnouts within the layover facility may be No. 8 if space is limited, but No. 10 are preferred.

Horizontal Geometry

The maximum curvature in the main body of the layover facility should not exceed 6°-00' and the maximum curvature on approach tracks and within ladder tracks should not exceed 12°-30' if No. 8 turnouts are used and 8°-00' if No. 10 turnouts are used.

ROADWAY/PARKING DESIGN

Pavement Section

Pavement shall be bituminous concrete over a minimum of 12" well compacted gravel borrow. The pavement should be a minimum of 4 inches thick placed in 2 courses; a 2 1/2 inch base course and a 1 1/2 inch top course.

Vehicular Access/Circulation

Provision must be made to allow access to all locations within the layover facility for fuel trucks, fire apparatus and other vehicles, even when the facility is full of trainsets. Because there is generally not enough room to turnaround within the space between the tracks, crossings must be provided at least at both ends of the facility to allow for vehicle circulation. Care should be taken to provide crossings of adequate width and placement to accommodate the turning radius of expected fuel delivery and emergency vehicles. The design should be sufficient to allow SU-30[1] or WB40[1] design vehicles to pass through without backing.

Employee Parking Area

The employee parking areas should be located just outside the train storage area, but enclosed within the security fence. The number of spaces should be computed as follows:

- 1 engineer per trainset.
- 1 trainman/conductor per 1.5 cars and roundup when there are an odd number.
- 2 spaces for supervisors and other transient personnel.
- 5 spaces for maintenance personnel.

The spaces should be 9′ x 18′ with a clear space of 28′ for backing up. At the entrance, provide a "Parking for Employees Only" sign.

Access Road

Any access road from a public street should have a minimum width of 24′ if there are curbs, 28 feet with no curbs.

Minimum Slope, Paved Surfaces

Minimum cross slope of a paved surface should be 2.00% (1/4" per foot) in combination with a minimum longitudinal grade of 0.40%. Areas where this is not possible, such as transition areas, intersections and grade crossings should be kept to a minimum and a grade of 0.50% may be used in short sections.

ELECTRICAL DISTRIBUTION SYSTEM

This comprises a major element of the layover facility and consists of a 480 volt, 3 phase power distribution system for heating of trains, power distribution for electric track switch heaters on turnouts leading in and out of the facility, area lighting and the maintenance building.

1 American Association of State Highway Officials (AASHO) standard design vehicle designations. SU-30 is a single unit truck or bus with a minimum turning radius of 42′. WB-40 is a semi-trailer combination with a minimum turning radius of 40′.

Substation

The substation consists of a metal walk-in enclosure (NEMA 3R) housing switch gear, breakers and secondary metering for the entire facility. Also in the substation is a pad mounted 13.8 KV-480-277 VAC, 3 phase transformer, sized for the required load and a primary load interrupter switch. The equipment is mounted on a concrete slab which typically occupies a space of 13'-0" x 46'-0". The substation should be enclosed in a 72", 6 gage chain link fence with barbed wire top with a 4'-0" gate for personnel access and an 8'-0" cantilevered sliding gate opposite the transformer. The fence and gates must be grounded and "Danger, High Voltage" signs placed on all four sides of the fence enclosure.

Feeder Receptacle Stations

From the substation, 4" PVC conduits, concrete encased, containing power and control cables connect to the feeder receptacle stations within the layover facility. The feeder receptacle stations consist of an NEMA 3R enclosure complete with switches, local control box, indicator lights and a 25 foot long cable trough for storing the jumper cables for connection to the trainsets. These feeder stations should be located along the service road(s) next to the tracks (at least 8'-6" from center line of track) at locations where the cables can be connected to all trains in the yard. Cables can be plugged into the ends of all cars and locomotives, anywhere in the train. Cables cannot cross the access road, so that separate feeder stations are needed for each track. Placement of the feeder stations should also consider minimizing the duct bank lengths from the substation. Feeder stations should not be placed opposite each other unless there is sufficient width in the service road to allow vehicles to pass between. Each receptacle station shall be numbered with 8" high letters visible from all four sides. These numbers should be repeated on all corresponding switches and controls including those in the substation. Ground fault protection must be provided on all equipment. Indicator lights must be vandal and weather - proof and operating switches must be secured with a lockable cover to prevent un-authorized operation.

Area Lighting

Lighting within the main train storage area should be provided to produce a lighting intensity of two candle power. The recommended lighting is 250 watt high pressure sodium floodlights mounted 25 feet above grade on 35 foot wooden poles, two per pole, spaced in the range of 130 to 150 feet apart. Lighting poles should be placed near the feeder receptacle stations to provide maximum illumination at these locations and to minimize individual obstructions in the service road. There should be a pole mounted photoelectric sensor to provide automatic operation of the lighting system. In residential areas, lighting fixtures must be of a type that provides cut-off of light beyond the faciltiy. Power distribution should be underground in rigid steel conduits with precast concrete handholes spaced as required.

Switch Heaters

Electric track switch heaters should be provided on any turnouts necessary to move all the trainsets onto the main line by both the normal and emergency route. Power should be distributed underground from the substation in galvanized rigid steel conduits. Snowmelter control case(s) shall be provided containing step down transformers, manual switch, indication lights, ground fault relay, ground current sensor, contactors, circuit breakers, and a switchable 60 watt light for maintenance personnel. Provisions may be made for remote dispatcher control of the snowmelter system as directed on individual projects. All equipment must have full ground fault protection.

Maintenace Building

Power for interior lighting and heating must be provided for the maintenance building. Provide a separate breaker panel within the building.

WATER SUPPLY/DISTRIBUTION SYSTEM

This consists of "yard" type hydrants within the train storage area, fire hydrants as may be required for fire protection and safety, supply to the maintenance building, metering, shutoffs and a backflow preventer.

Yard Hydrants

The yard or service hydrants are small (2" diameter supply) hydrants used to supply water within the train storage area. They are normally used to top-off locomotive cooling systems, supply fresh water to fill on-train lavatory storage tanks and minimal car cleaning functions. The hydrants should be located so that a hose 100 feet or less in length can reach all train sets stored in the facility. The hydrants must be designed for manual operation without any special tools or wrenches and must be freeze-proof using a method that allows water to automatically drain out of the exposed portion of the hydrant after each use. If hydrants are located in the service roadway, they should be protected by bollards and in all cases, have a snow flag attached.

Fire Hydrants

Fire hydrants must be provided as required by local authorities. As a minimum, it is suggested that a town approved fire hydrant be provided at the main entrance to the facility. This would be the most accessible location to arriving fire apparatus and most likely be on or near the primary water supply line to the facility. Fire hydrants should be protected by bollards and have a snow flag attached.

Meter Pit & Backflow Preventer

Just outside the main entrance, a meter pit should be provided for installation of a water meter, backflow preventer, shutoff valves and reducers as necessary. The Department of Environmental Quality Engineering (DEQE) requires a backflow preventer in the meter pit to protect public water supplies from accidentally being contaminated in the event that a temporary loss in water pressure allowed connections to such things as locomotive radiators from backflushing into the system. DEQE has requirements for the size of the meter pit and other specifics.

Supply Line

The size of the new water service supply line, location and availability of existing water lines as well as the method or type of connection to the existing water distribution system must be coordinated with and be in compliance with the requirements of the local water company.

SANITARY SEWER SYSTEM

A sanitary sewer is required from the lavatory in the maintenance building and the toilet dumping facilities within the train storage area.

Toilet Dumping Facility

The toilet dumping facility consists of a flexible pipe for connection to the trains which in turn is connected to a concrete collar over a sanitary sewer line. These should be located adjacent to the storage tracks, one per trainset in a location near the end of the train opposite the locomotive end.

Sewer Connection/Septic System

The sanitary sewer system should preferably be connected to existing municipal facilities, if available. If not, a complete septic system of sufficient capacity must be provided. Due to potential problems associated with ground water levels, soil permeability, etc., which affect septic system design; it is suggested that these factors be investigated early in the site selection process.

DRAINAGE SYSTEM

Depending on the area of the proposed pavement, general situation of the site, location and use of abutting property, local requirements and other considerations, it may be desirable or necessary to provide a closed drainage system. The drainage system should efficiently remove storm water from the facility and prevent water from entering onto the property of abutters in a way or in volume which would damage the abutters property.

Minimum pipe size should be 12 inch diameter with runs between inlet structures to be less than 300 feet apart. Pipes are preferred to be reinforced concrete, although corrugated metal, lined with a bituminous coating may also be used. The system should be designed to accommodate a fifty (50) year design storm.

The point of discharge should be the natural water course draining the area or, in urban areas, the existing storm drainage system. In the case of an existing storm drain, permission must be obtained from the local authorities and investigations made into the capacity of the existing system to absorb additional discharge. Most towns will require that the final drainage structure prior to discharge into their system include a sump or trap of sufficient size to prevent debris from entering their system.

Direct discharge into an existing stream or pond requires the filing of a "Notice of Intent" with the local Conservation Commission. They will issue an "Order of Conditions" stating the measures that must be taken. At a minimum, they may require that all drainage structures have sumps and may also require that all discharge be passed through an oil separator. The benefits of passing storm drainage from parking areas and service roads through an oil separator are somewhat questionable. However, the possibility always exists of an accidental spill, of a petroleum product. Large volumes of water which are possible from paved areas at times of heavy rainfall can flush any separated oil out of a separator. It is suggested that an inlet control or weir structure be employed in front of the separator to prevent this flushing. The very occasional and short duration high rainfall events are allowed to pass directly to the discharge point. All other flows (up to about one inch per hour intensity) are passed through the separator. (see also following section on oil separators) Retention ponds are another way of providing protection with large runoffs if there is sufficient room available for the size of the pond required.

OIL/WATER SEPARATORS, OIL COLLECTION SYSTEM

In general, it is the Authority's intent not to use oil separators and collection systems as they require a high level of maintenance to remain effective and are an ongoing cost.

As discussed in the section on Drainage Systems, an oil/water separator may be required by local conservation commissions for all surface storm water runoff from the facility. The primary source of potential contamination is however, localized at the points where the locomotives are spotted. It is recommended that if local authoritys require an oil collection system, it be limited to only that portion of the layover facility. This will limit processing large volumes of water from the entire facility where spills are highly unlikely and increases the probability of containing oil and grease from the higher risk locomotive storage areas.

Oil Drip Pans

The oil collection system begins with fabricated metal track pans assembled to form a continuous trough 11'-4" wide by about 76'-0" long. These pans must be located where the locomotives are normally spotted (The end of the train facing away from Boston). Pans may be assembled into longer units to accommodate locations where locomotives are not spotted in the same area at all times. These pan installations require that every third tie be 11'-0" long.

Piping

From the pans, eight inch cast iron or ductile iron pipes, at least 2 per 76' pan, collect all drainage from the pans and direct it into the oil separator. The minimum slope of the pipes should be 0.50%. The pipe size, slope and spacing is intended to provide sufficient capacity to handle a large accidental spill of oil from a locomotive fuel tank leaking or rupturing. The number of elbows, tees, wyes, etc. should be kept at a minimum and consideration be given to access for cleaning.

Oil Separator

The separator(s) is normally a gravity type and must be sized to allow sufficient retention time for separation to occur. A minimum retention time of five minutes is recommended by the American Petroleum Institute. An important consideration when designing a separator is to make provisions to prevent fluid from "short circuiting" through it. That is, providing baffles and locating the inlet and outlet at the maximum distance from each other so that incoming fluid cannot stream through the tank and go right to the outlet. The unit must also be vented to prevent the system from becoming air-locked. The separator may be cast-in-place concrete or, if small enough, precast concrete. However, it is recommended that a manufactured metal tank type be used with hold down straps and a concrete base slab. These specially made units have built-in baffles, access openings and other features to make them generally more cost effective and efficient than a built-in-place unit.

Separators passing drainage from the entire facility must be sized for the expected flow with a five minute retention time. If volumes are greater than can be handled, an inlet control structure or weir may be considered to limit the flow into the separator to a rainfall intensity of one inch per hour. Separators used to only collect discharge from oil drip pans may be sized to hold the oil volume of a diesel locomotive tank, typically 1500 gallons.

MAINTENANCE BUILDING

General Layout

For mechanical department maintenance functions and supply storage, a small concrete block or insulated metal sandwich type building must be provided. The overall size of this building should be not less than 16' x 24' with a clear height of nine to ten feet. The building should be partitioned into three sections including a 16' x 16' storage area, an 8' x 8' office area and an 8'x 8' lavatory area containing a water closet and sink. The office space should have one window and a 36 inch x 7 foot insulated steel door. The lavatory should have one window and a 30" wide door from the office area. The windows should be openable and have integral vandal-resistant insect screens. The remaining storage space should have no windows but two manually operated louvers about 2 foot by one and one half feet near the top of opposite walls for ventilation. An eight foot by eight foot overhead door should be located in the sixteen foot wide wall on the end opposite the office space and a 36 inch x 7 foot insulated steel door on the sidewall near the door to the office. Five metal personnel lockers and an electric hot water heater should be located in the storage area. The walls and roof of the building must be insulated and all doors have keyed locks which can be operated by one key.

Foundation

The building shall be set on a concrete grade slab with a perimeter frost wall. Top of slab grade should be at least six inches above finished grade. Provide a four foot deep concrete landing at the 36 inch doors and a concrete ramp or apron for vehicular access at the eight foot square overhead door.

Electrical/Lighting

Provide two, eight foot long, two tube flourescent ceiling fixtures in the main storage area with a wall mounted switch and two convenience outlets. In both the office area and lavatory, provide one four foot long twin tube flourescent ceiling fixture with a wall mounted switch and two convenience outlets. Provide thermostatically controlled electric heating units within the main storage area of sufficient capacity to maintain a minimum temperature of 60 degrees farenheit with an outside ambient temperature of zero degrees farenheit and a separate thermostatically controlled system in the office/lavatory area capable of maintaining a temperature of 65 degrees when the outside temperature is zero degrees farenheit. Provide an electric service distribution/ circuit breaker panel for the building inside the office area.

Miscellaneous

The office should have a telephone and the office and lavatory floor should be covered with vinyl tiles. The storage area floor should have two coats of gray paint formulated for use over concrete. The lavatory should have a metal water closet partition and door, toilet paper dispenser, paper towel dispenser, a mirror, soap dispenser and a small shelf near the sink. An electric hot water heater must be provided.

FENCING

The entire layover facility must be enclosed in a 72 inch, 6 gage chain link fence with a three strand barbed wire top. Double swing gates, not less than 19'-0" wide are provided at all track crossings and vehicular access roads should have 24'-0" wide double swing or sliding cantilevered gates. All double swing gates should include a center stop and drop rod. The fence should have MBTA Standard "No Tresspassing, No Dumping" signs located at intervals not exceeding 500 feet and at all gates.

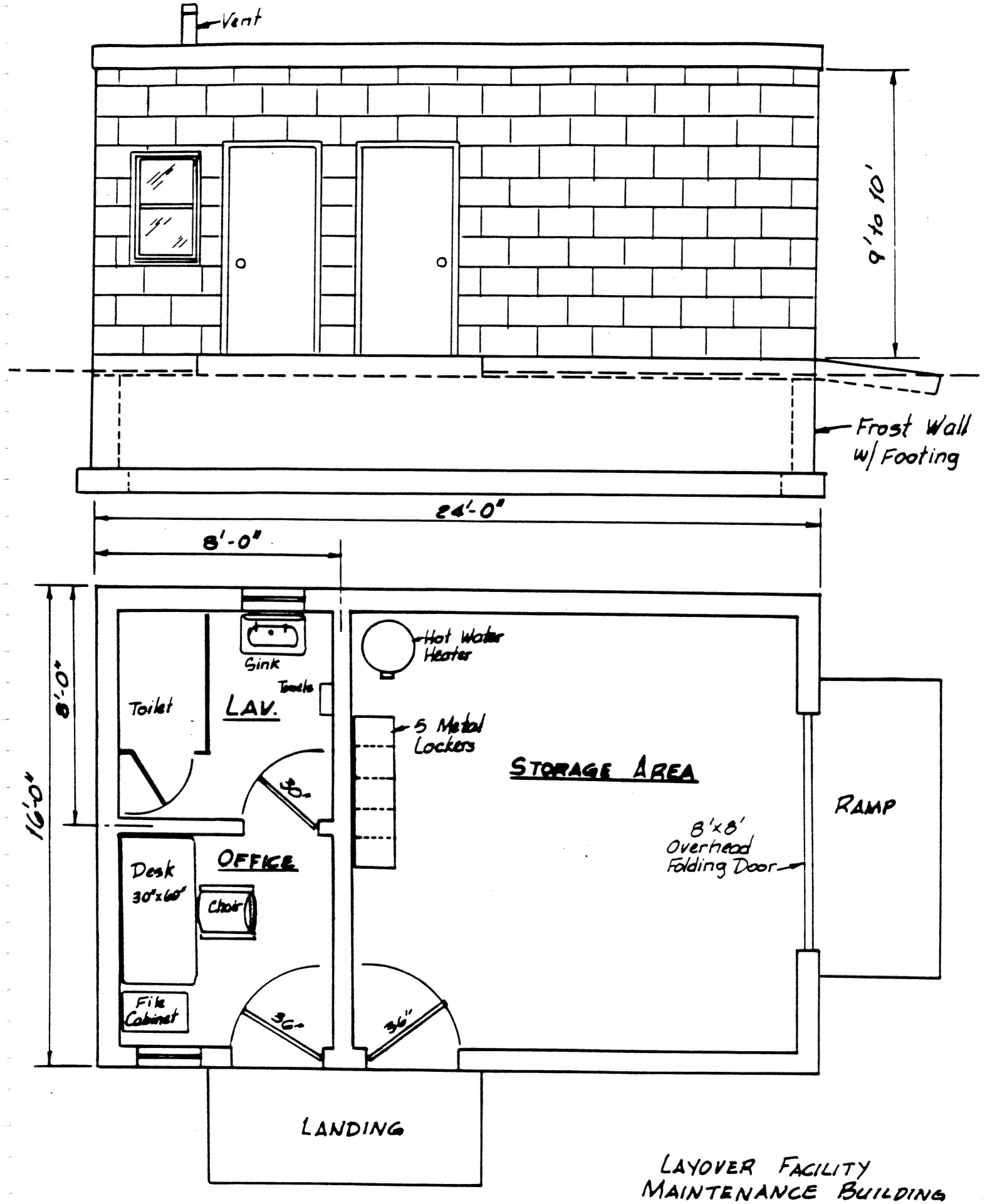
SIGNAGE

Specific signs required have been referenced in previous sections. In summary, the signs required, as a minimum, are as follows:

- "No Trespassing, No Dumping, Police Take Notice, Massachusetts Bay Transportation Authority". Size 18"x24". On all entrance gates, including train entrance gates, and on all sides of perimeter security fence at intervals not exceeding 500 feet or at any change in direction of fence more than 30°.

- "Employee Parking Only, Massachusetss Bay Transportation Authority". Size 18"-24". One at entrance to employee parking area and at least 2 additional inside parking area.

- "DANGER HIGH VOLTAGE". Size 12"x18" minimum. One each on all four sides of the fence around the electrical substation and two each at every feeder receptacle station.



LAYOVER FACILITY
MAINTENANCE BUILDING
(Absolute Min. Size)
1/4" = 1'-0"